

# Meiosis

(How sex cells reproduce)

Sep 17-8:00 PM

## Lets Review

A living organisms will produce sexually and/or asexually.

One form of asexually reproduction that cells will undergo is mitosis.

Before Mitosis can begin Interphase must occur.

Interphase - a stage in the cell's lifecycle in which the cell will grow and replicates it's DNA

Sep 17-8:14 PM

## Review of Mitosis

Mitosis consists of four stages which can be remembered using the acronym P-M-A-T.

**Prophase** - Chromatid pairs form  
 - Nuclear membrane dissolves  
 - Spindle fibers form and attach to the chromatid pairs

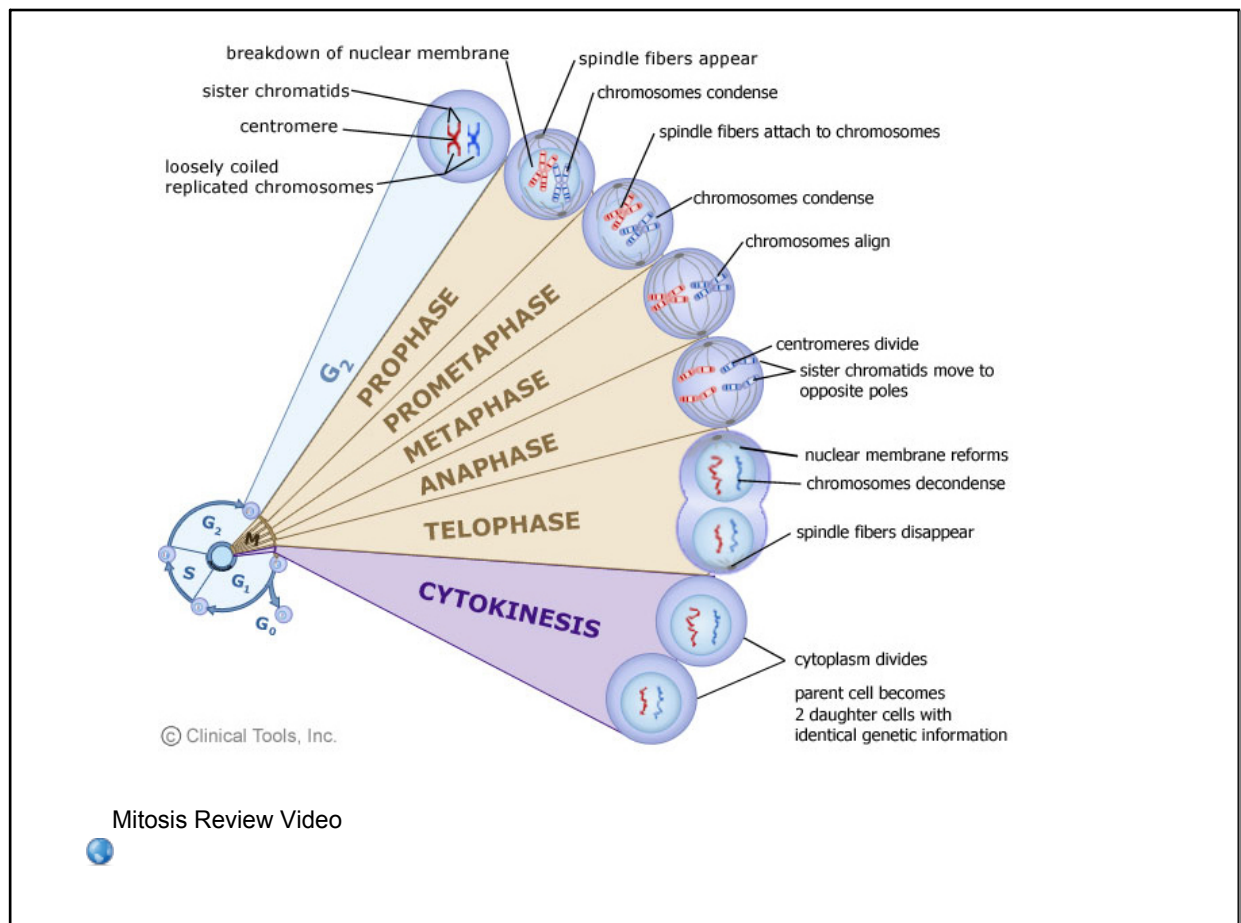
**Metaphase** - Chromatid pairs align at the equator of the cell

**Anaphase** - Chromatid pairs separate and chromosomes are pulled to opposite sides of the cell

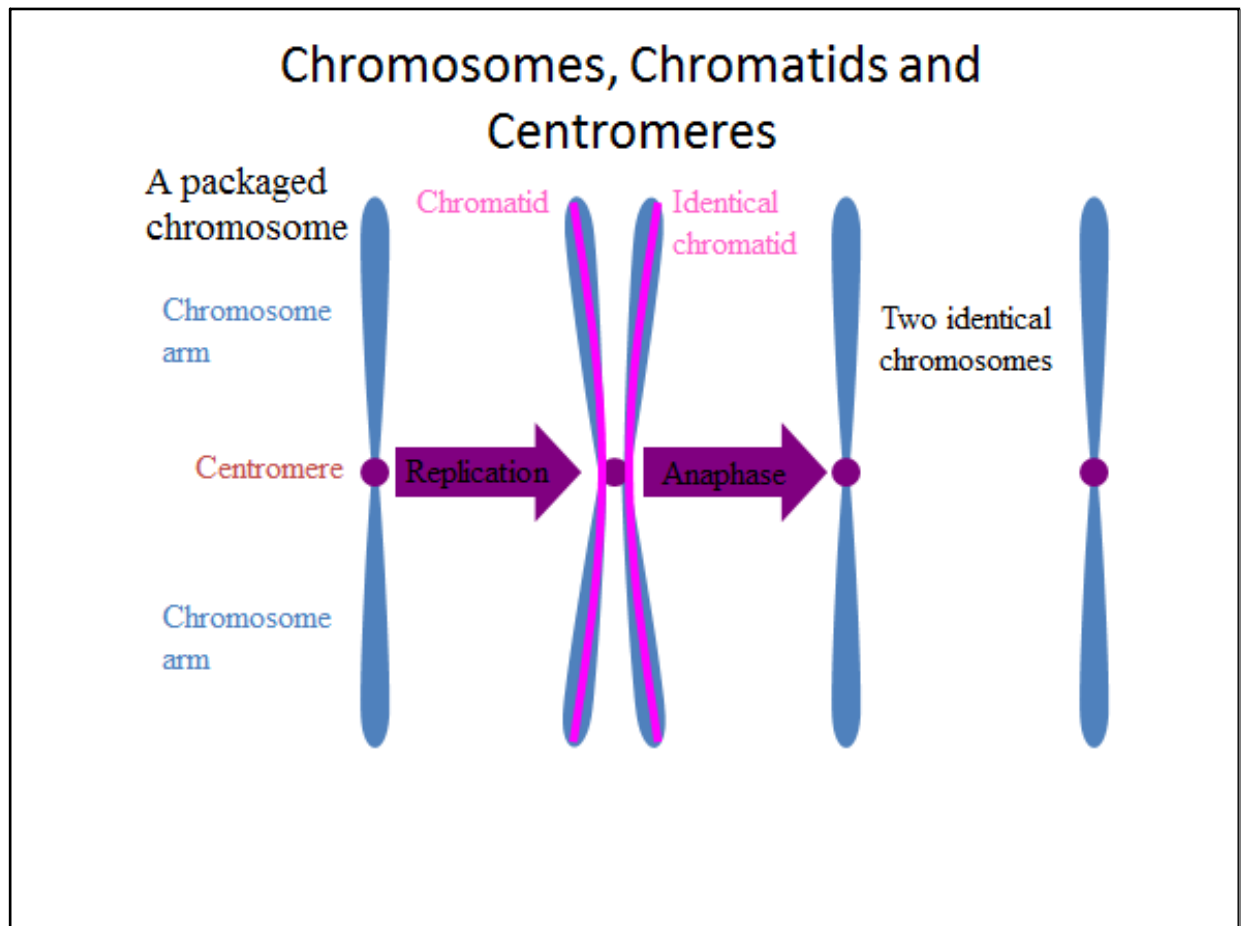
**Telophase** - Nuclear membrane reforms  
 - Cytokinesis occurs

*1 Mother Cell becomes 2 Daughter Cells*

Sep 17-8:00 PM



Sep 17-8:00 PM



Sep 17-8:28 PM

## Chromosomal Inheritance

During sexual reproduction an organism receives half of its chromosomes from the 'male parent' and the other half from the 'female parent'.

Ex. Fruit flies have 8 chromosomes (4 from a male parent and 4 from a female parent)

These two sets of chromosomes are homologous - each chromosome from the male has a corresponding chromosome match from the female.

Sep 18-9:39 PM

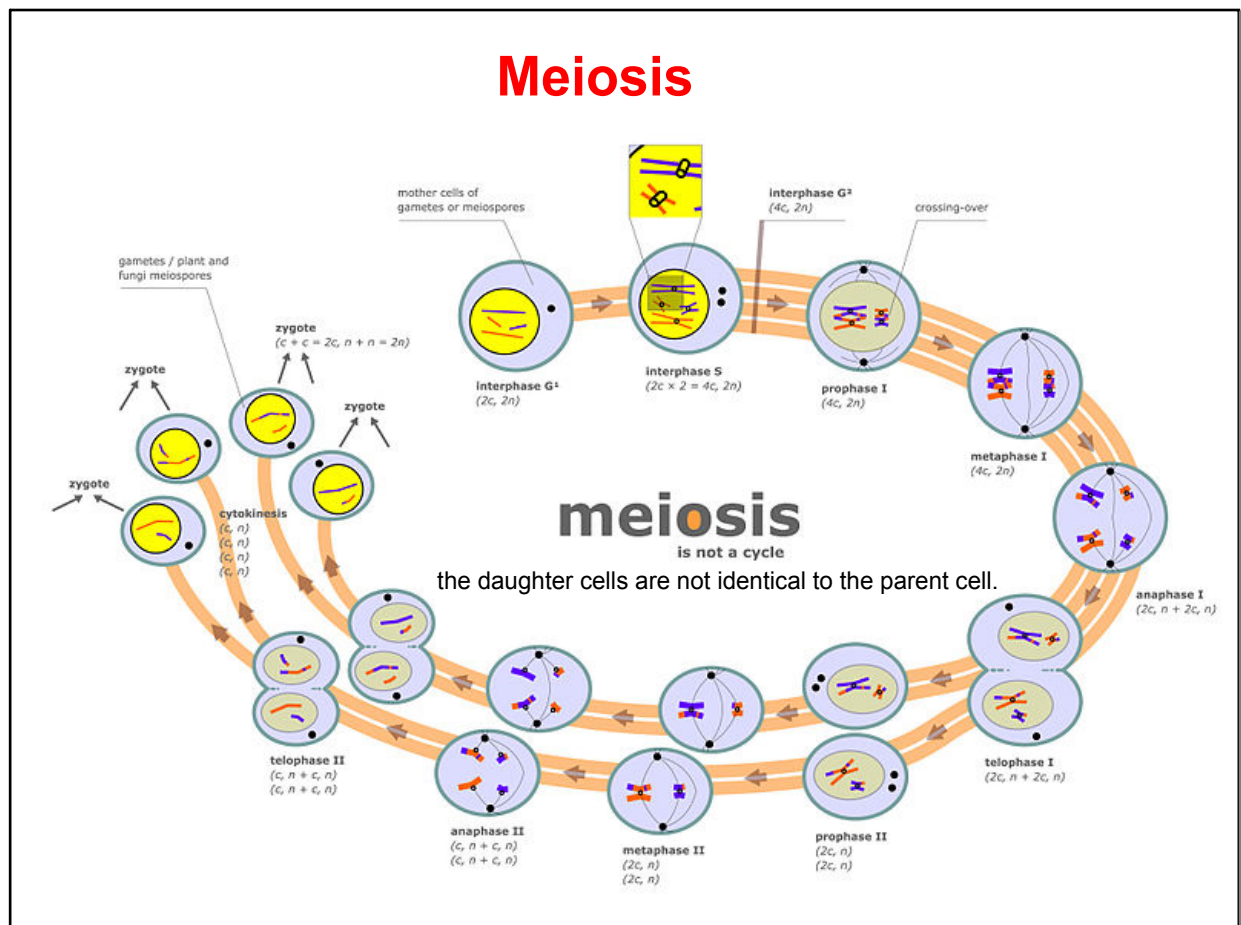
A cell that contains both sets of homologous chromosomes is said to be **diploid** (two sets of chromosomes = two sets of genes). Diploid cells can be represented using the formula  $2N$

Example: for *Drosophila* the diploid number is 8, symbol  $2N = 8$

The gametes of sexually reproducing organisms contain only a single set of chromosomes (therefore one set of genes) and are said to be **haploid**. Haploid cells can be represented as  $N$

Example: for *Drosophila* the haploid number is 4, symbol  $N=4$

Sep 18-9:51 PM



Sep 17-8:29 PM

**Meiosis** - the process by which sex cells are created.

Human somatic cells contain 46 chromosomes (23 from mom and 23 from dad). Human sex cells contain only half that number (23 chromosomes). When an egg and sperm unite to make a fertilized egg, the chromosomes add up to equal 46.

Sep 17-8:37 PM

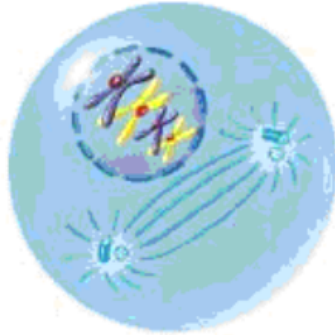
### Meiosis

- produces haploid sex cell or gametes
- consists of two stages: Meiosis I and Meiosis II
  - one replication of DNA and two cell divisions
- for every reproductive cell (germ cell) that enters into meiosis four haploid sex cells are produced

However before meiosis can begin Interphase must occur.  
(DNA Replication)

Sep 17-9:03 PM

Example Cell:  $2N = 4$

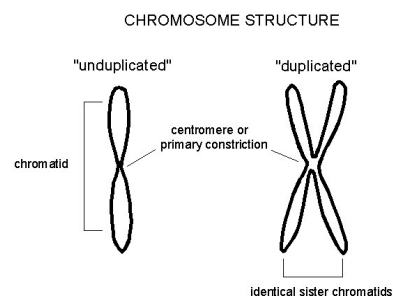


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## Meiosis I

### Prophase 1

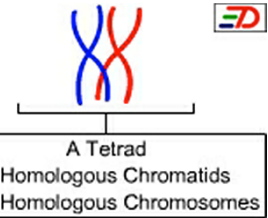
- nuclear membrane disappears
- Spindle fibers form
- replicated chromatin forms into chromatid pairs (chromosomes)
- synapsis occurs



Sep 18-9:31 PM

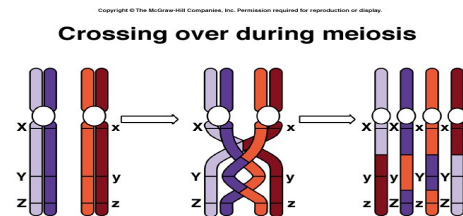
## Synapsis

- each chromosome pairs with its corresponding homologous chromosome to form a **tetrad**.
- there are 4 chromatids in a tetrad

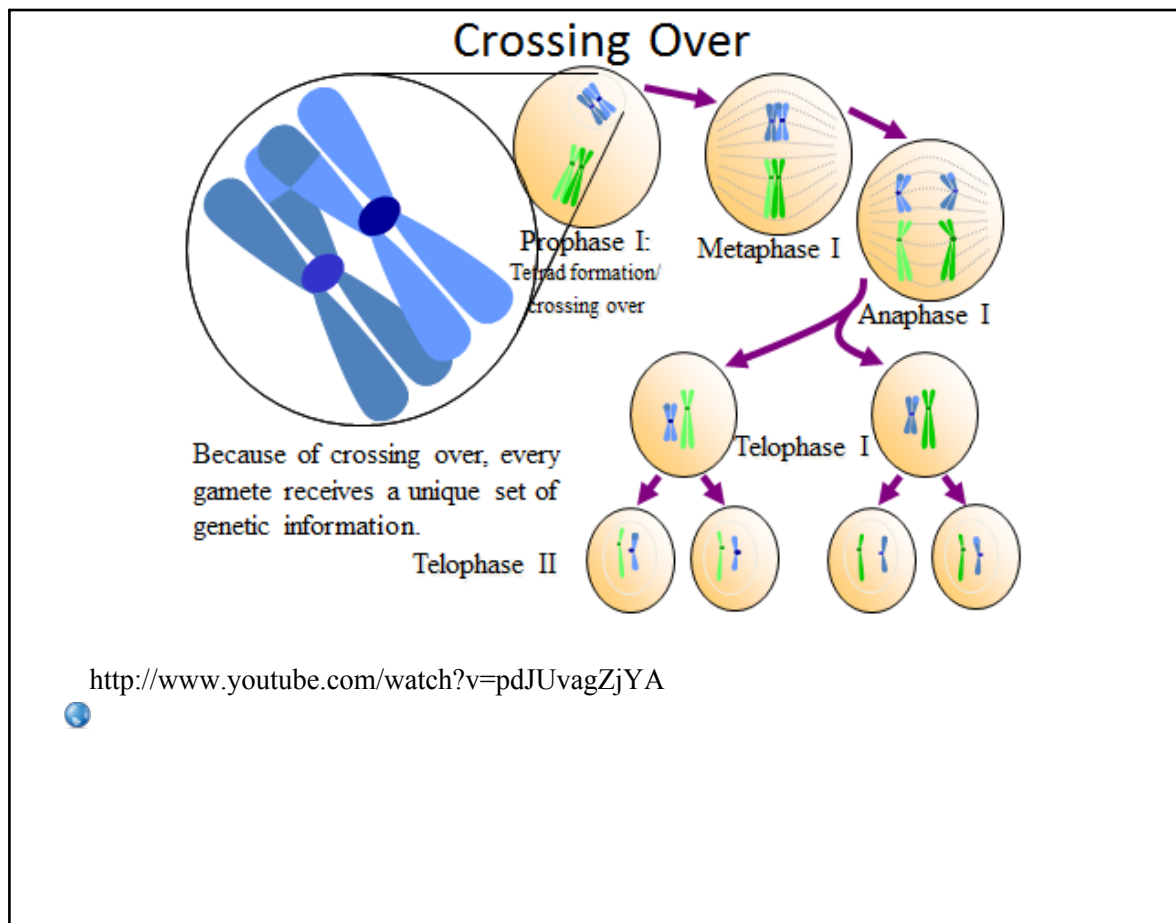


- after the tetrad forms the arms of the chromatid pairs exchange segments in a process called **Crossing Over**.

- Where the chromatid pairs cross over is called the **Chiasma**.
- Crossing Over increases genetic
- diversity in sex cells



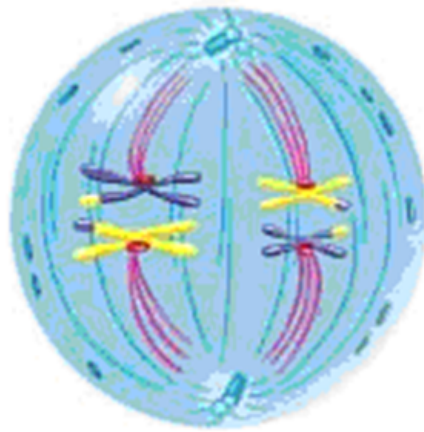
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Sep 18-10:28 PM

## Metaphase 1

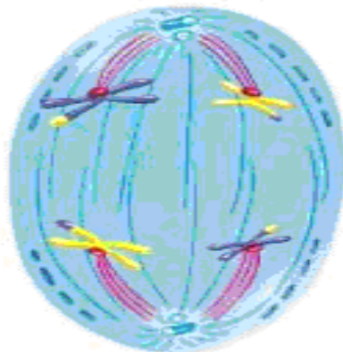
Tetrads align at the equator of the cell.



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## Anaphase 1

- Tetrads separate in a process known as disjunction
- Chromatid pairs are pulled towards opposite ends of the cell

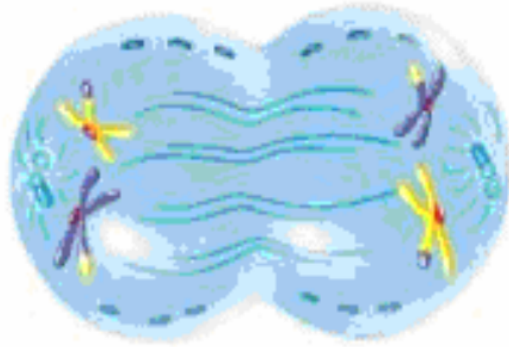


Sep 18-10:51 PM



## Telophase I

Cytokinesis splits the cell in two and ends Meiosis I



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## Meiosis II

The cell doesn't enter into another stage of Interphase rather it jumps right to Prophase II

Sep 18-10:55 PM

## Prophase II

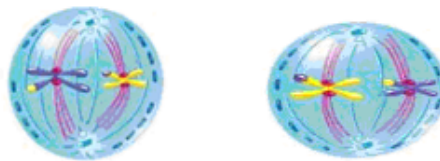
- Nuclear envelope disappears
- Spindle forms
- Chromatids are floating throughout the cytoplasm



Sep 18-10:58 PM

## Metaphase II

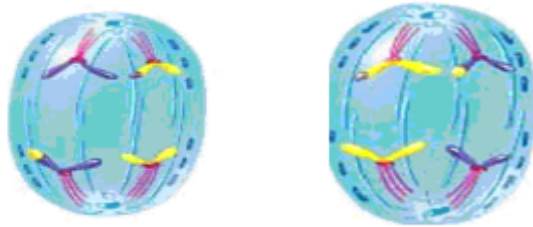
- Chromatids align at the equator of the spindle



Sep 18-10:59 PM

## Anaphase II

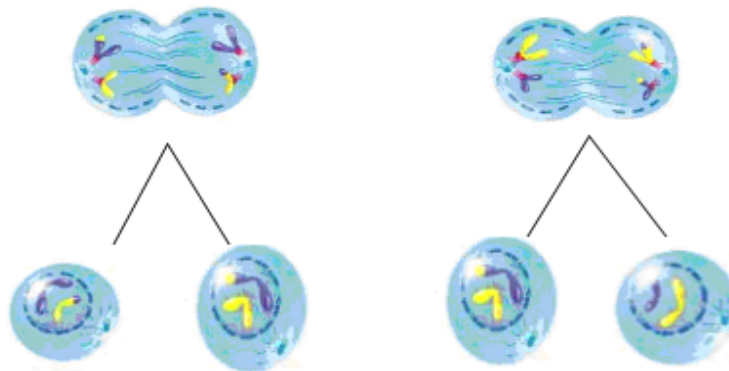
- Chromatid pairs split and chromosomes are pulled to opposite sides of the cells



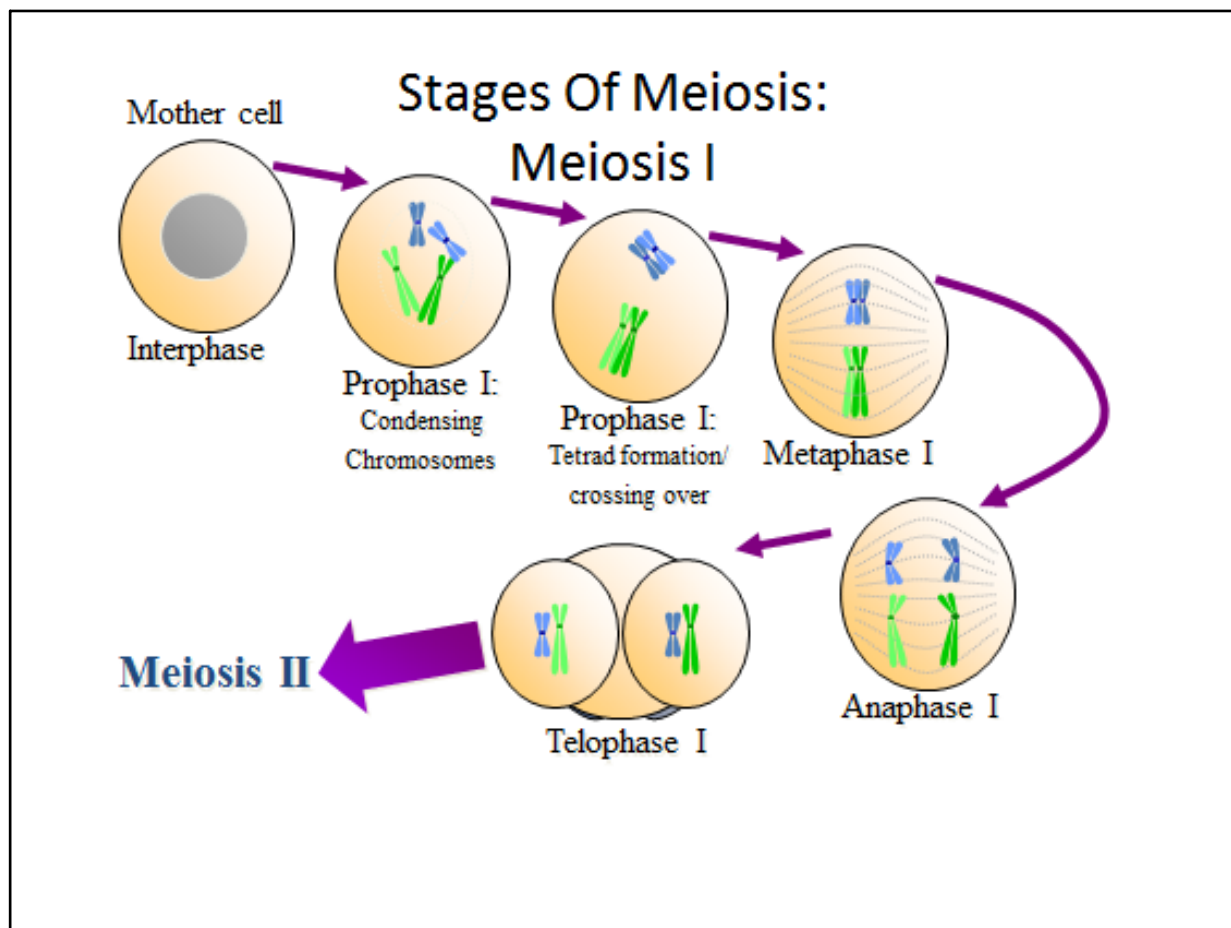
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## Telophase II

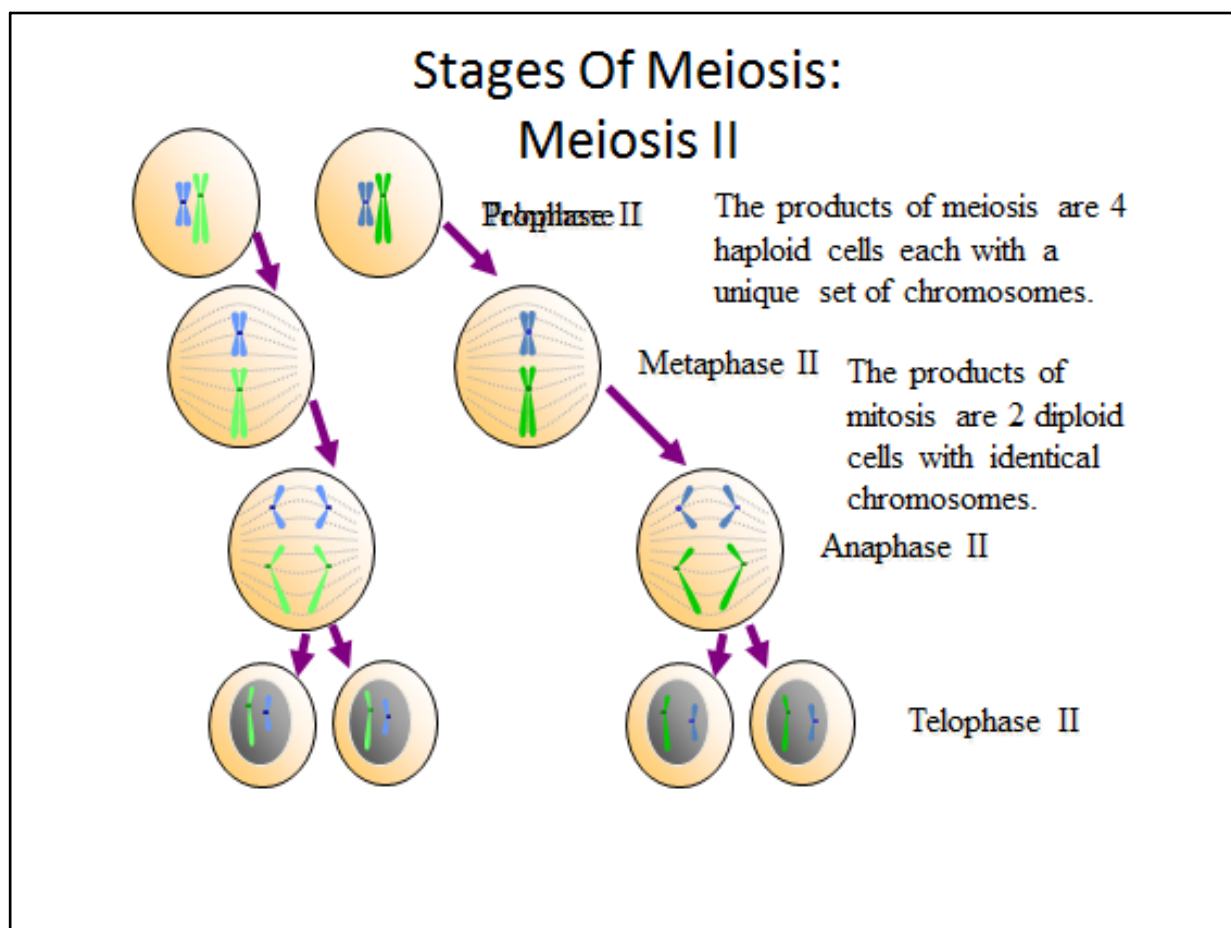
- Cytokinesis splits the 2 cells into 4 Haploid sex cells. ( $n=2$ )



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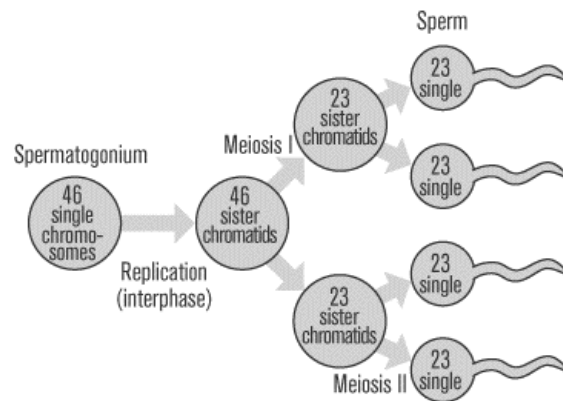
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## Spermatogenesis

- male testes have tiny tubules containing diploid cells called spermatogonium (mature to become sperm)
- each spermatogonium is eventually turned into 4 haploid sperm cells

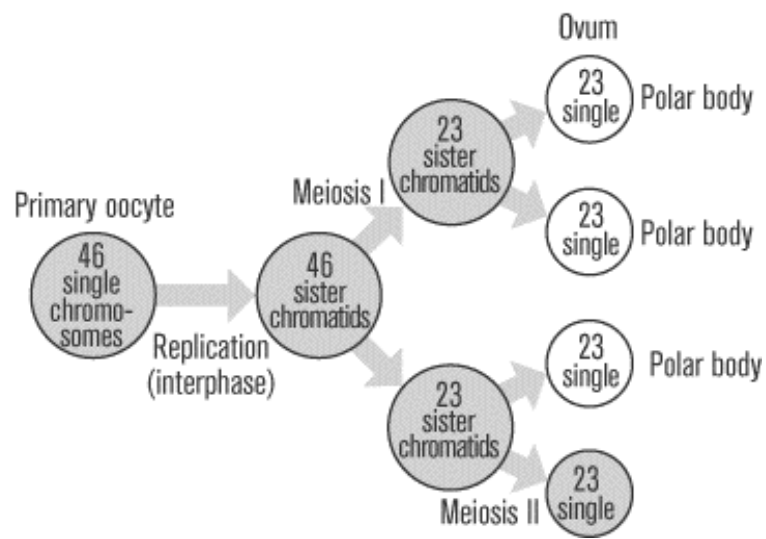


Sep 22-10:31 PM

## Oogenesis

- formation of haploid cells from an original diploid cell (primary oocytes)
- oogenesis only leads to the production of one final ovum (or egg cell)
- Of the four daughter cells that are produced only three come out much smaller than the fourth. These smaller cells (polar bodies) eventually disintegrate leaving the ovum.
- occurs once a month from puberty to menopause

Sep 22-10:36 PM



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